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soil. A mobile dispensary guards his family's health. A village school teaches the children how to read and write. Roads lead to neighbor villages and market towns. Small factories process cotton and other crops, giving employment and income to villagers who can be spared from the farms.

Best of all, Mohammad is no tenant sharecropper. He is buying the place just as Americans do—on the easy-payment plan. Farm income will be small, but with hard work the Karim family will own house, farm, and stock outright in 45 years. "Allah be praised," says Mohammad.

The Thal Desert covers five million acres—an area the size of New Jersey—encompassed by the Indus River and its big Chenab-Jhelum tributary. Its development is one unit in a vast reclamation operation begun by the British and now carried on by Pakistan. Desert areas of west Punjab and Sind are being reclaimed as living room for displaced people. At present the Thal project is the show piece of the country's war against refugee want and disease. Visitors call it "Pakistan's pride" and "the most cheering thing in Pakistan today."

Besides the Jinnah Barrage, the $100,000,000 Thal project under the Punjab provincial government includes hydroelectric plants and hundreds of miles of canals. The villages are scattered checkerboard fashion on all parts of the desert that are flat enough to be prepared for irrigation.

Agriculture normally progresses from the ox to the tractor and other big farm machinery. On the Thal, American-made bulldozers and tractors have come first to level dunes by the thousand, preparing the land in village-size blocks. Then the refugee farmers take over with their bullocks and plows.

Already nearly 50,000 people have been resettled in Thal villages covering 400,000 acres. By early 1957 the number is expected to reach 270,000 spreading on 1,500,000 acres. Eventually the reclaimed desert may support half a million displaced people.

When the first farmers moved there in 1950, drinking water was

Plodding Past an Irrigation Ditch, Camels Bring Bricks to a Thal Housing Project

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Pakistan's Thal Desert Comes to Life

Mohammad Karim is sitting pretty. He can't remember when his outlook was brighter. With his wife and three children he settled last year in one of many new villages on West Pakistan's Thal Desert.

Before, the Karim family somehow had managed to survive six long years of squalor in a crowded refugee camp in Lahore, capital of Pakistan's Province of Punjab. Like millions of other devout Moslem families they came into Pakistan as soon as they could, following its creation as a separate nation eight years ago this summer.

Penniless like most of their fellow migrants, the Karims abandoned their old home to cast their lot with the new Moslem state rather than remain in India where the Hindu faith prevails.

The hard years dragged by. But the government was not idle. Resettlement of thousands of refugees began as lands became available. Suddenly the Karims found themselves in a Thal village with 49 other families. They have a new two-room house that to them is a dream of luxury. Like their neighbors they also have 15 acres of land all their own—as much as two large blocks in most American cities.

From the Jinnah Barrage (dam) on the Indus at Mianwali (above), irrigation canals bring water. With it, Mohammad and his friends are transforming the long-forsaken Thal into a garden of wheat, cotton, sugar cane, and vegetables.

Nor is that all. A bullock, a plow, and other farm tools are Mohammad's along with the house and land. A district agricultural expert supplies seeds and advises him about planting, and how best to work the

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It's hard to ply certain broad reaches of the Rhine on a sight-seeing steamer like the one above without falling prey to the river's history and legend. To the enchanted traveler, the city of Bonn loses significance as West Germany's capital and seems to become again an ancient Roman outpost garrisoned by homesick centurians.

Across the river from Bonn tower the Seven Mountains, scene of Snow White's story. The Nibelung gold is supposed to be sunk beneath these very waters. Drachenfels (Dragon Rock), one of the seven peaks, is the setting of Siegfried's triumph over a dragon whose blood made the legendary hero almost impervious to battle wounds. From quarries on the slopes came stone for Drachenburg castle near by, and for Cologne's cathedral, reputedly the last resting place of the bones of the Three Wise Men.

The tourist has no eyes for the 20th century as he approaches Lorelei Rock, near Rheinfels, where an ill-starred maiden supposedly drowned herself and then spent a long immortality luring fishermen and sailors to destruction with her voice.

But once sated with Teutonic mythology, the sight-seer is struck by the Rhine's modern legend—the true fable of the valley's postwar industrial recovery. Industry hums along these riverbanks. Barges heavily laden with coal from Ruhr mines serve the booming factories of Duisburg, Düsseldorf, Bonn, Koblenz, Mainz, and Frankfurt—cities which held the Roman line against eastern barbarians fifteen centuries ago.

Cargo vessels glide down through Rotterdam and on to the sea, their holds crammed with Rhine manufactures—chemicals, textiles, machine tools, processed food, glass, ceramics, wood products, and innumerable other wares for world markets. Smoking factories and steel plants outstrip a hundredfold the heroics of Siegfried, Hagen, and all the knights of the Nibelungenlied.

Mass production and myth share the spotlight along this most theatrical of European rivers. Seven hundred miles of changing scenery, from snow-capped Alpine peaks to the waterlogged lowlands of its delta country, give the Rhine a special character that sets it apart from other rivers which may be longer, wider, deeper.

Traditional costumes of three Meersburg girls harmonize with the half-timbered houses and floral lanes of this typical Boden See village

NATIONAL GEOGRAPHIC PHOTOGRAPHER
VOLKMAR WENTZEL

The river is formed by a handful of turbulent streams which gush from glaciers and lakes in Switzerland's eastern canton of Grisons. Welded together, and nourished by over 200 mountain brooks, the baby Rhine flows north, separating Switzerland from the tiny principality of Liechtenstein and from Austria on the east. Vineyards and orchards along these upper banks give way to bustling towns as the young river enters the Lake of Constance (Boden See to the Germans), an emerald jewel around which Austria, Germany, and Switzerland stand guard. Tilled fields paint the lake shore in varying shades of green, while gabled village homes match

scarce and sand storms frequent. The earliest crops were poor. Gradually the shifting sands have come under control with the planting of trees and grasses along canals and roads and in and around villages.

Ten million trees a year are taking root in once arid soil, most in 15,000-acre forest-reserve areas, some in the several large orchards. Each village has its own 50-acre forest some day to provide fuel.

Help for Pakistan's Thal project comes from the United States and many other sources. The World Bank financed the purchase of tractors to level the land. The Colombo Plan supports a big livestock farm where Australians and New Zealanders work to develop dairy herds suited to the region. Australia supplies tube wells to drain areas that become waterlogged after a few years of irrigation. Canadians have set up a cement factory. Germans have trained Pakistanis in hydroelectric operations.

The Thal Desert achievement is double—reclaimed land and reclaimed citizens to work it.

References—Pakistan is shown on the National Geographic Society's map of Southwest Asia. Write the Society, Washington 6, D. C., for a map price list. *National Geographic Magazine*, March, 1955, "East Pakistan Drives Back the Jungle"; April, 1954, "Troubled Waters East of Suez"; Nov., 1952, "Pakistan, New Nation in an Old Land"; GEOGRAPHIC SCHOOL BULLETINS, Oct. 4, 1954, "Karachi's Industry Gets New Lease on Life"; March 8, 1954, "History Still Marches Through Khyber Pass"; March 30, 1953, "Pakistan Sets the Experts Wondering." *School and library discount price for Magazine issues a year old or less, 50¢; through 1946, 65¢. Write for prices of earlier issues.*

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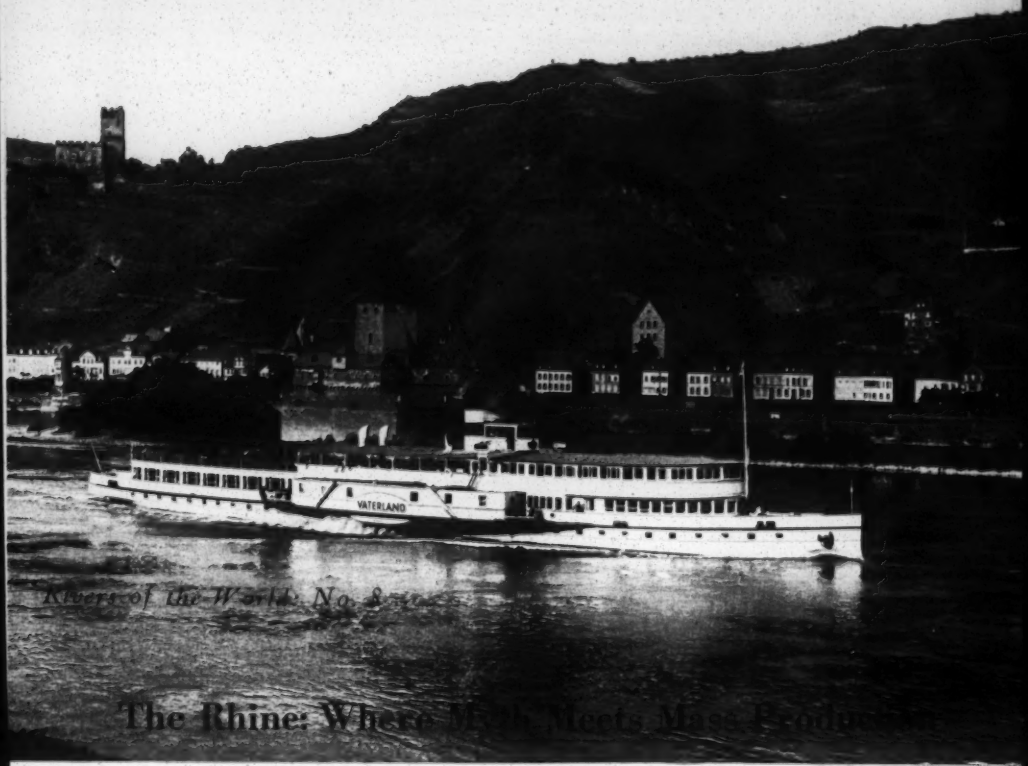

Rivers of the World: No. 8

The Rhine: Where Myth Meets Mass Production

in weathered stone watchtowers that share the upper Rhine scene with slender white church spires of mountain villages. Charlemagne, Martin Luther, and Napoleon made history here. So did Count Ferdinand von Zeppelin, born at Constance, who, near Friedrichshafen, developed the dirigible that bears his name. General Omar Bradley wrote a new chapter of Rhine history when his American armies crossed the river in 1945—the first time Germany's inner defenses had been stormed from the west in more than a century.

Hitler's army couldn't withstand the Allied invasion that brought about its collapse. But in earlier days Rhenish nobles fought off the raids of their enemies as a matter of routine. Between the famous

With its tributaries, the Rhine laps the soil of eight nations. Napoleon annexed the Low Countries and part of Germany, claiming they were formed from "the sediment of French rivers." Now vessels of many countries wind through the 86,600-square-mile Rhine Basin nurturing the heartland of Western Europe.

WILLIAM BUDD

At Basel, Switzerland's Rhine Port, Three Nations Meet—France is on the far-left bank, Germany on the far right, while the sight-seers in the foreground stand atop a Swiss building. Barges bring nearly 4,000,000 tons of raw materials into Basel each year to feed Swiss factories.

their frescoed walls with the steep backdrop of wooded mountains.

Prehistoric lake dwellers built their homes here, some 12,000 years ago. The structures were raised on stilts sunk in the waters of the lake, yet so firmly were the foundations laid that enough remained to give modern scientists a working pattern for restoration.

In the deep green waters of this second-largest Swiss lake, the Rhine leaves much of the mud and debris it has acquired from the mountain slopes. It emerges westward, clear and green, to tumble over cliffs that form the falls of Schaffhausen and act as the frontier of Switzerland and Germany.

When the river reaches Basel, start of ocean-going navigation and Switzerland's thriving "seaport," it right-angles to flow north between France and Germany. Westward rise France's Vosges Mountains; Germany's Black Forest mantles the heights to the east with fir and pine. This Baden-Wurttemberg upland is the home of cuckoo clocks and wooden toys.

In its northward course the Rhine, flowing through Europe's most densely populated area, cuts through four mountain ranges—the Taunus, Hunsrück, Eifel, and Westerwald, before it reaches its most famous city, Cologne. Then the land flattens through industrial Germany and the dyked lowlands of the Netherlands.

Through the entire stretch from Switzerland to the plain, the Rhineland is a realm of wooded heights crowned by picturesque ruined castles, ancient fortifications, crumbling churches, and deserted monasteries, with toylike villages nestling in nooks and crannies of the landscape.

Caesar's legions ousted the Celts from these banks and left their mark

AUSTRALIAN NEWS AND INFORMATION BUREAU

Flying Doctors Serve Australia's Outback

To find Alice Springs on the map of Australia, prick the center of the continent with a pin. Imagine a hill-rimmed oasis and railroad terminus whose tidy bungalows and irrigated gardens defy arid, empty land on every side.

Australians call their country's central region its "dead heart." Yet a faint pulse beats among the sun-baked flatlands, the bleak, eroded mountains and dried lake beds of the interior. From "Alice," trucks grind northward on the military road to coastal Darwin. On blazing deserts that spread south and west a handful of prospectors search for gold, opals, uranium. About 300 miles east begin the widely scattered stations of western Queensland—where hardy ranchers raise beef cattle on tracts so huge they are measured in square miles. Everywhere small groups of aborigines hunt, move from one job to another, perhaps just follow their inexplicable native urge to "go walkabout."

When sickness or injury strikes in this inhospitable "outback," Australia's unique Flying Doctor Service comes to the rescue. Small radio transmitters send word to Alice Springs. A doctor listens to the patient's account of his symptoms, then, if possible, prescribes treatment over the air. If the patient needs hospitalization, a plane is dispatched. Pilot and nurse or doctor jump out with a stretcher. They administer first aid, then load the patient aboard. In an hour or two he is tucked into a hospital bed at Alice Springs, another routine case.

Virtually the only organization of its kind in the world, the Flying Doctor Service is the dream come true of the late Dr. John Flynn.

UMI

NATIONAL GEOGRAPHIC PHOTOGRAPHER VOLKMAR WENTZEL

Restored and revived after the wreckage of war, iron and steel mills like these near Duisburg in the booming Ruhr turn night into day with the glow of their production as they forge a new Rhineland legend

Lorelei Rock, above Koblenz, to Bingen, there is a castle for every one of the 13 miles. The robber barons of the Middle Ages who built these structures used to lie in wait for the ships bringing rich cargoes up and down the river. A captain was forced to pay tribute before being allowed to continue his voyage. After a number of such halts the vessels were likely to ride high in the water.

Largest of the castles, Rheinfels, was last occupied by Prince William IX of Hesse who sold his troops to England for use against the American colonists. Ehrenbreitstein, opposite Koblenz, was occupied by American troops after World War I. Heidelberg castle, a few miles east of the Rhine on its tributary, the Neckar, was blown up by Louis XIV in 1693 and by lightning in 1764. Virtually all the castles are now in ruins. A great many were destroyed in the Thirty Years' War of the early 17th century and those that survived fell to Louis, noted for his castle-wrecking.

"Castles on the Rhine" may be famous, but commerce within the river basin has controlled much of Europe's economy since the Middle Ages. The fabulous wealth of the Indies, shipped across the Mediterranean to Venice and Genoa, came over Alpine passes to Rhine vessels which transported it far and wide through Europe. Up- and downstream river boats carried woolen cloth, flax for linen, wine from Rhine vineyards, and fish caught and salted in North Sea villages of the Netherlands.

Today Rhine cargoes add up to nearly a hundred million tons annually. Some estimates indicate that they exceed those of the Mississippi.

References—The Rhine is shown on the Society's map of Western Europe. *National Geographic Magazine*, Jan., 1949, "With Uncle Sam and John Bull in Germany"; Jan., 1947, "What I Saw Across the Rhine"; July, 1945, "War's Wake in the Rhineland"; June, 1936, "Cologne, Key City of the Rhineland"; July, 1925, "Rediscovering the Rhine"; GEOGRAPHIC SCHOOL BULLETINS, Jan. 31, 1955, "Report from Germany, 10 Years After."

base serves as a message center for its listeners. Every day contact is established between the base and each distant settlement. The doctor checks progress reports from old patients and arranges to make flying visits to new ones. The radio operator reads private telegrams over this wide-flung "party line." He broadcasts news—international headlines, society briefs, editorial comment, a hint of spring fashions, the latest cricket or tennis scores, and the winners of Melbourne and Sydney horse races.

Then it's time for school. Teachers give lessons to children they may never have seen. Written work, mailed in previously, is criticized and marked over the air.

No one can feel forgotten in Australia's Never Never Land as long as the voice of a radio can summon winged help in a matter of a few hours. Even the remotest prospector carries a small "transceiver" to relay messages for help. Nursing a snake bite or broken leg, he needs only wait until the silence of the brassy desert is broken by the welcome snarl of an approaching plane.

The aborigine, often ill with such white man's diseases as measles or whooping cough, has learned to appreciate the same sound when it obtrudes upon the familiar quiet of his own hunting ground.

References—Alice Springs may be located on the Society's map of Australia. *National Geographic Magazine*, Jan., 1946, "Earth's Most Primitive People: A Journey with the Aborigines of Central Australia"; Dec., 1936, "Beyond Australia's Cities."

This Doctor's Bedside Manner Works Perfectly 3,000 Feet in the Air. He Carries on the Dream of John Flynn, Spreading a "Mantle of Safety" over the Inland

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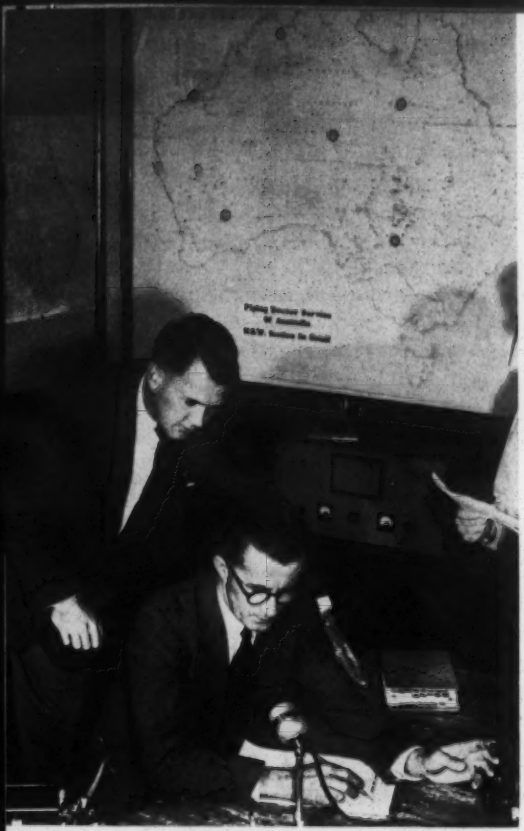

AUSTRALIAN NEWS AND INFORMATION BUREAU

Flying Doctor often prescribes over the base radio when a call for help is received. Aid comes quickly in serious cases (below) where nurse and pilot prepare patient for flight to hospital

"Flynn of the Inland" trekked into central Australia with a string of camels in 1908. A Presbyterian minister, he soon saw that the isolated life in his vast parish was almost unbearably hard. Simple injuries, untended, could mean death even to vigorous outdoorsmen. Mail took months to arrive on the humps of imported Afghan camels. Urgent messages reached their destination in the cleft twig (Yabba stick) of an aboriginal runner.

After World War I Flynn wanted to try aerial ambulances. But without communication, planes would be useless, he knew. With an engineer friend, he developed the pedal radio, a simple two-way set whose current was generated by pumping bicycle pedals. Radio communication enabled the first trial flight to get off the ground in 1928 at Cloncurry in northwestern Queensland.

Since then, the service has spread until all the dead heart of Australia lies within radio and flying range of one or another of the eight bases. The work of Flynn and other pioneer idealists caught the imagination of Australian city dwellers who contributed generously. The federal government established a subsidy.

Today the old pedal radios have largely given way to better models. Outback housewives use them to carry on "back-yard" conversations with neighbors 100 miles away. Besides offering medical care, each Flying Doctor

PHILIP R. HASTINGS

Sap's Aflow in Vermont's Sugarbush

Nights are still frosty in Vermont at this time of year, but there is a tingling warmth to the sun that hints of spring's approach. To the farmer, this weather means the sap of his maple trees is starting to flow.

With a bit brace he drills carefully about two inches into the trunks, then taps a spout into each hole and hangs a bucket on it. If snow is packed deep in his sugarbush, or grove of sugar maples, he drills low, like the Vermonter at the left, so the buckets will hang waist high when the ground is bare.

Warm days and cold nights bring a constant drip of sap into buckets. It is carried to the sugarhouse either in the old-fashioned sledge-drawn gathering tank, or in new-fangled pipe lines. Boiled down, it becomes syrup. Vermont remains top producer of this breakfast-table delicacy. Its chief maple-syrup county, alone, accounts for nearly a quarter of a million gallons a year. But Maine, New Hampshire, New York, Ohio, and Canada's Province of Quebec are all close contenders to the Green Mountain State's maple-sugar leadership.

New England folklore attributes the invention of maple syrup to the squaw of an Indian chief. She was preparing her husband's favorite treat, plain maple sap, warmed over a fire. But she forgot and let it boil. Fearfully, she served it to him, and with relief saw the beam of joy light his face after the first taste.

Presumably, the squaw had removed the pot at the exact moment when the boiling sap reached a density of eleven pounds to the gallon and became syrup. But had she allowed it to boil longer, it would have crystalized into maple sugar and delighted the chief just as much.

References—*National Geographic Magazine*, April, 1954, "Sugar Weather in the Green Mountains"; GEOGRAPHIC SCHOOL BULLETINS, March 31, 1952, "New England Shows off Its 'Sugarin' off'."